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[54] **AUTOMATED BUILDING CONTROL DESIGN SYSTEM**

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[52] U.S. Cl. 364/464.01; 364/188; 364/512; 364/521
[58] Field of Search 364/188, 189, 190, 192, 364/464, 512, 518, 521, 464.01

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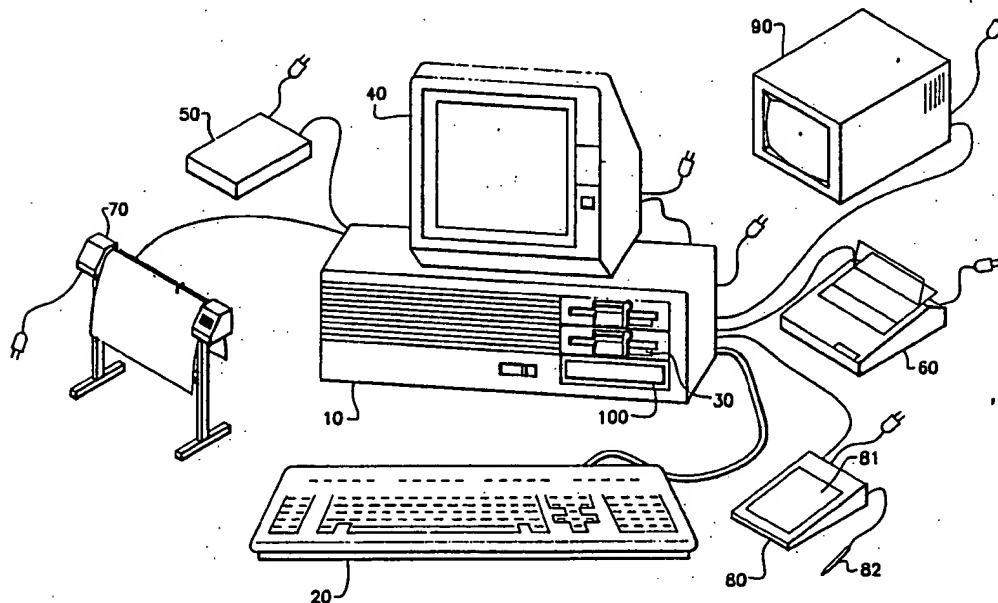*Assistant Examiner*—Edward R. Cosimano
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[57] **ABSTRACT**

Disclosed is a computer system for substantially automating the design of a building control system. The system comprises a processor for processing data stored in a data base, the data being related to a building control system design and comprising both graphic and alpha-numeric information. The processor comprises the ability to call up on a display an initial drawing related to a building control system element. The initial drawing comprises graphic and related alpha-numeric information including an identifier associated with the element and a prompt guiding modification of the initial drawing. The processor also includes the ability to create a modified drawing by incorporating changes into the initial drawing, the modified drawing being related to a building control system design.

101 Claims, 18 Drawing Sheets

Abstract Text - ABTX (1):

Disclosed is a computer system for substantially automating the design of a building control system. The system comprises a processor for processing data stored in a data base, the data being related to a building control system design and comprising both graphic and alpha-numeric information. The processor comprises the ability to call up on a display an initial <u>drawing</u> related to a building control system element. The initial <u>drawing</u> comprises graphic and related alpha-numeric information including an identifier associated with the element and a prompt guiding modification of the initial <u>drawing</u>. The processor also includes the ability to create a modified <u>drawing</u> by incorporating changes into the initial <u>drawing</u>, the modified <u>drawing</u> being related to a building control system design.

US Document Identifier - DID (1):

<u>US 4885694 A</u>

Brief Summary Text - BSTX (3):

In the prior art, such systems have typically been designed manually using pencil, paper, manuals, texts and many man hours of arduous labor. Furthermore, when a supplier in the prior art designed a building control system, its personnel manually accomplished most of the related engineering, job estimating, customer proposals, job bookkeeping, system component ordering, <u>drawing</u> drafting, job labor scheduling, job billing processing, job recording, and other general administrative matters.

Brief Summary Text - BSTX (6):

The present invention is a computer system for substantially automating the design of a building control system. The invention comprises a processor for processing data stored in a data base, the data being related to a building control system design and comprising both graphic and alpha-numeric information. The processor comprises the ability to call up on a display an initial <u>drawing</u> related to a building control system element. The initial <u>drawing</u> comprises graphic and related alpha-numeric information including an identifier associated with the element and a prompt guiding modification of the initial <u>drawing</u>. The processor also includes the ability to create a modified <u>drawing</u> by incorporating changes into the initial <u>drawing</u>, the modified <u>drawing</u> being related to a building control system design.

Drawing Description Text - DRTX (1):

BRIEF DESCRIPTION OF THE <u>DRAWINGS</u>

Drawing Description Text - DRTX (2):

The following is a brief description of the <u>drawings</u> wherein like numerals refer to like elements herein.

Drawing Description Text - DRTX (16):

FIG. 13 is a flow chart which shows in block diagram form a typical menu penetration procedure for displaying <u>drawings</u> with control sequence ready to be placed according to a scheme of the invention.

Detailed Description Text - DETX (3):

Accordingly, in the preferred embodiment, there are many functions offered to system users of the present invention. A basic function, however comprises designing and drafting in order to generate a <u>schematic drawing</u> of a desired building control system. As previously indicated, the present system can also be configured so that equipment requirements are

automatically itemized on a bill of materials, installation and engineering labor are automatically determined, and the dollar value of installation material is automatically determined. Job proposal processing, which comprises selecting proposals from a forms data base and automatically modifying and producing them, may also be integrated with the present system. Labor scheduling may also be incorporated so that, for example, manpower requirements are automatically displayed for a requested time period for single or multiple jobs. Ordering materials including the devices required for installation of a building control system which has been designed by the present invention may also be substantially automated by generating purchase orders from information automatically extracted from a bill of materials generated by the present system. The present system may also comprise a job billing function wherein a bill form is selected from a forms data base, automatically modified, and sent to the customer. Record keeping may also be integrated with the present system so that correspondence is automatically updated and maintained. The present system may also comprise a function for automatic backup or restoration of all information in the system such as **drawings,** memoranda and proposals. The present system may also be configured to operate in remote locations and networked with other remote locations or with a central location for transmitting such things as building control system design data, manpower requirements, and material orders between locations.

Detailed Description Text - DETX (4):

The finished system **drawing** or series of **drawings** provided by the present invention typically includes all elements of a building control system designed for a particular customer. For example, the **drawing** or series of **drawings** could include all electronic, automation, fire and security, and pneumatic systems necessary to meet a system specification. Electronic systems, for example, could include temperature, humidity and pressure sensors, automatic controllers, and software modules. Automation systems, by way of example, could include central control monitoring and control equipment for maintenance scheduling, management reporting of energy consumption, or monitoring temperatures for danger levels such as temperatures less than thirty-two degrees in areas with water pipes. Fire and security systems could include systems for fire and smoke detection and control as well as the systems necessary for detecting and preventing unauthorized access or entrances. Pneumatic systems are typically environmental control systems which make use of temperature, humidity and pressure controls. Electronic, automatic, pneumatic and fire and security systems typically employ wire and cabling for interconnection and pneumatic systems also employ pneumatic (compressed air) piping for interconnection.

Detailed Description Text - DETX (5):

To implement an automated building control system design process, the present system typically comprises generalized software packages. These include a menu software package (such as the package sold by Magee Enterprises under the trademark "Automenu"); word processing programs (such as Ashton-Tate's product sold under the trademark "Multimate Advantage") capable of importing text from, and exporting text to, other programs; a filing system program (such as Ashton-Tate's product sold under the trademark "On-File") capable of importing text from other programs, sorting, filing, indexing, searching, and displaying or printing selected items; a Computer Aided Design (CAD) package (such as Autodesk Inc.'s product sold under the trademark "AutoCAD") with features of menu customization, engineering symbol customization, and the ability to import files from, and export files to, other programs, and to print **drawings** utilizing a device such as a plotter or dot matrix printer; if the CAD package does not contain its own, a conversion package (such as the Technical Software, Inc. product sold under the trademark "AutoWord") for converting files to be imported into a CAD package; a data base package (such as the AshtonTate product sold under the trademark "dBase III+") capable of importing files from, and exporting files to, other programs in addition to customization features such as setting up records or making calculations based on data in records contained in a data base; a generalized spreadsheet (such as the Microsoft Corporation product sold under the trademark "MultiPlan"); a communications package (such as the DTSS Incorporated product sold under the trademark "DaTapaSS"); a cartridge tape backup package (such as the Colorado Memory Systems, Inc. product sold under the trademark QIC-60 Tape Back up System and operating system software (such as Microsoft Corporation's product sold under the trademark "MS-DOS").

Detailed Description Text - DETX (7):

As can be seen with reference to FIG. 1, the above listed known programs operate as one unit to implement the invention. As can be seen with reference to FIG. 1 and the other Figures, these programs when combined with the appropriate data bases substantially automate the design of a building control system. Examples and details of the functional operation of the invention herein below further illustrate the cooperation between these elements. In order to better understand the manner in which this cooperation is achieved in invention, the following example is interposed prior to explaining the invention in detail. As can be seen in FIG. 1, the word processing program at Block 502 cooperates with the administrative functions Block 501, receiving inputs from that Block, as well as from the job take-off function 500. The word processing program supplies data to Blocks 503 and 504 for creating, updating, printing and searching various documents and/or a card file system. The menu program is used throughout, as exemplified in the various Figures, to generate many different menus. See, for example, menu 320 in FIG. 6 and menu 410 in FIG. 7. A filing system program is also used throughout the system to import text from other programs, sorting, filing, indexing, searching and displaying for printing selected items as shown, for example, in Blocks 503, 504, 516 and generally throughout the system. The CAD package of the system is mainly used to create and update job **drawings,** as in Block 509 and to plot and store such job **drawings** as shown in Block 517. The CAD system accepts data

converted to CAD format from the bill of materials in Block 514 and the card file system in Block 504 as well as element capacity information from Block 505 and initial information from the job take-off Block 500. As also shown inherently in FIG. 1, the data base package is used extensively throughout the system by the various functional blocks to, for example, assemble the bill of materials as shown in Block 511 or create and update labor and material costs as shown in Block 510. The generalized spreadsheet program is used in, for example Block 510 to create and update the job estimate for labor and material costs. As is known by those skilled in the art, such spreadsheet programs contain the ability to make such calculations on a routine basis. The communications package may be included in the system in order to enable the user to obtain information from locations or data bases which are at a remote location. This information could be inputted at various points in the system including the job take-off point Block 500. The cartridge tape backup package would be used in connection with the backup/restore system data function Block 521. With reference to the flow of information shown in FIG. 1, those skilled in the art will readily appreciate that the above-listed programs cooperate to substantially automate the design of a building control system.

Detailed Description Text - DETX (12):

When the two display devices 40 and 90 of FIG. 2 are used, typically one is used for a display such as shown in FIG. 3, which illustrates a building control system **drawing** 120, a prompt line 130 (indicating what input information is expected, for example, "Command:" displays), a menu 140 of functions, and a status line 110 which may indicate CAD **drawing** user information.

Detailed Description Text - DETX (14):

Help messages provide the user with specific information about building control systems and the elements contained in **drawings such as the drawing** illustrated in FIG. 3. When help messages fill a significant portion of a screen, they are most conveniently displayed on screen 40, i.e., on a screen separate from graphic screen 90. Help messages are typically entered or edited through the use of a text editor such as Microsoft Corporation's text editor identified with the trademark "EDLIN". Such text editors are a component of operating systems such as Microsoft Corporation's product sold under the trademark "MS-DOS". The help messages are typically maintained in a computer aided design package file such as the ACAD.HLP file found in Autodesk Inc.'s product identified under the trademark "AutoCAD".

Detailed Description Text - DETX (19):

Both of these users make use of the preferred embodiment of the present invention to automatically select an initial **drawing** related to a building control system element, the element comprising one or more **drawing** symbols contained in a data base comprising graphic symbols. Such elements can represent single devices, a building control subsystem, or even an entire system; further, the elements can comprise either standard system elements or elements which have been customized for particular customer needs, locations, and the like. These standard or customized building control system elements, e.g., control devices, can then be combined or otherwise modified through the present invention to create a modified **drawing** of a building control system meeting job specifications.

Detailed Description Text - DETX (20):

When using the present system, a salesman will typically be finished in block 510 when the job estimate is completed and ready to bid to a customer; an engineer will typically be done when job installation **drawings** are ready for distribution, block 517, labor is scheduled, block 515, and orders are placed for all the required controls and installation materials, block 518.

Detailed Description Text - DETX (21):

In other words, in a typical project, the preferred embodiment of the present system is used to estimate and bid the job and then, as soon as an order is received, the job proposal (estimate) is converted into a job file in block 508. Then the engineer will typically compare the salesman's job takeoff with the most current job plans and specifications and modify any necessary details in the building control system, distribute finalized job **drawings,** schedule installation labor, and order all of the required materials. While these uses are typical, many other uses of the present system will be recognized by those skilled in the art.

Detailed Description Text - DETX (27):

Block 518 provides an option for automatically placing job orders. A job order normally specifies what devices must be ordered to install a building control system described in a system **drawing** or series of **drawings**. The ordering system option as shown in block 518 typically takes information from the block 511 bill of materials program and the block 513 accessory program, and performs order entry. Typical order entry functions include information such as where to ship the building control

system components and how to group the components for multiple shipments. If the devices are stocked by the building control system supplier, the order is typically electronically transmitted to the appropriate supplier sourcing location. If it is not a supplier-stocked component, a vendor purchase order is transmitted, e.g., by modem or hard copy.

Detailed Description Text - DETX (28):

A block 514 option allows the user to create a complete bill of materials. In the preferred embodiment, a bill of materials is typically created in block 514, transferred to the job **drawing,** block 517, through the use of a block 519 conversion program, and stored on a **drawing** page basis within a job or proposal. Block 512 gives the user an option for printing a hard copy (or a copy on electronic media) of the bill of materials and/or for inserting the bill of materials on a job **drawing**.

Detailed Description Text - DETX (29):

Block 507 optionally creates and maintains information on job proposals and sold jobs. Accordingly, block 507 may be used to create a record referred to as a job file, which typically contains all job information such as job **drawings,** job bid information, bill of materials, damper and valve schedules, labor schedules, etc.

Detailed Description Text - DETX (32):

In block 517, the user has the option of printing the **drawings** and associated information such as sequences of operation and a bill of materials in hard copy form or on electronic media. This will typically be done at the completion of a design.

Detailed Description Text - DETX (39):

Block 509 creates and updates job **drawings** as each symbol or element is stored within the data base or CAD system as a **drawing**. Block 509 is discussed in further detail below with reference to FIG. 8.

Detailed Description Text - DETX (40):

Block 519 converts data from Block 504 or Block 514 to CAD format which is then used by Block 509 to create and/or update job **drawings**. An example of the use of this option for converting a bill of materials to CAD **drawings** is shown in FIG. 5.

Detailed Description Text - DETX (42):

With the above overview in mind, a more detailed description follows. As previously indicated, a system comprising the present invention typically employs symbols in **drawing** form which represent the elements of a building control system. These symbols or combinations of symbols can be called to a screen, together with simultaneously displayed alpha-numeric information, in order to substantially automate the design of a building control system through the present invention.

Detailed Description Text - DETX (43):

Graphic symbols stored in a data base or a Computer Aided Design (CAD) package can be used for representing such things as dampers, fans, sheet metal duct work and air compressors. Symbols can represent, or can be combined to represent, each control or mechanical device used in a building control system. FIG. 3 represents a sample building control system **drawing** comprised of symbols on a display screen, the symbols representing elements of the building control system. Thus, FIG. 3 is an example of a **drawing** related to a building control system element; within the present invention, such a **drawing** or element may comprise a single element or component of a building control system, or it may represent a combination of such elements or devices, e.g., it may represent a building control subsystem or system.

Detailed Description Text - DETX (46):

A digitizer 80 typically comprises a surface 81 and a pen 82. Movement of pen 82 over surface 81 translates to movement of a position indicator on the display of a display device such as 90. A digitizer 80 facilitates use of prompts such as menus and the creation and modification of **drawings**.

Detailed Description Text - DETX (47):

Optionally, the digitizer may be supplied with an overlay which simultaneously displays the majority of the desired system elements and **drawing** commands, thus making it significantly easier, particularly for the new user, to choose required system elements and **drawing** commands without having to search through successive on screen menus. Accordingly, together with other features of the present system, use of an input device such as a digitizer or mouse substantially automates selection of commands and symbols and greatly facilitates the placement and integration of element symbols into a modified **drawing** related to a specific building control system design.

Detailed Description Text - DETX (49):

The ability to extract alpha-numeric information related to graphic symbols or elements stored in the data base or CAD package is dependent upon the assignment of attributes to these elements. Typically the attributes assigned are those for the alpha-numeric or model identifier, quantity required and a construction use code. These attribute assignments are accomplished through block 509 as each symbol or element is stored within the data base or CAD system as a **drawing**. Typically, the assignment of attributes is carried out at the end of the symbol **drawing** process. The assignment of attributes normally follows a fixed repetitive sequence for each attribute, such as by using CAD menu commands and prompts. For example, using typical CAD menus and prompts, each new symbol requires the user to assign a tag (attribute identity), a specific symbol prompt phrase, default value, insertion point (typically adjacent to the symbol) and to respond to several further system questions. The sequence must normally be repeated for each attribute assigned to a symbol or element.

Detailed Description Text - DETX (50):

A significant advantage of the present system is that each user of the system can gradually customize the graphic and alpha-numeric information stored in the system in order to meet local customer needs. For example, in order to speed up the application of building controls to a specific customer's repetitive needs, new building control installation **drawings** may be developed. It is then normally appropriate to add to the system menus the specific customer system designations. These might read for example, as follows: XYZ Co., Mixed air control, Single Zone Discharge control, VAV control, etc. The point of adding these customer designations (which means adding new menu choices, prompts, help messages and XYZ systems **drawings** developed from "generic" standards) is that, when a job is being estimated or engineered for this specific customer, it can be done much faster by using systems that are already customized to the customer's specific needs.

Detailed Description Text - DETX (51):

The present system preferably includes the use of a CAD or other system with the ability to relate an alpha-numeric identifier with a **drawing** related to a building control system element; this is useful to a system user, who can then retrieve a symbol of a system element (or a combination of such symbols) through a menu listing of relevant identifiers.

Detailed Description Text - DETX (52):

Accordingly, the designer of a system comprising the present invention typically generates a menu (or a series of menus) displaying appropriate alpha-numeric identifiers representing every system element or other building control system **drawing** stored in the data base of the present system. From this menu, the user can select a symbol, system element or other system **drawing** repeatedly when creating a **drawing** without having to recreate the symbol, system element or other system **drawing**. As previously indicated, the user can also customize and store for later retrieval any symbol, system element or system **drawing** by making modifications to such symbols, system element or other system **drawing**; these modifications are normally made by using display, draw, edit and similar CAD type commands in the system. The user may then modify relevant menus in order to more easily retrieve the modified **drawings**; such menu modifications may be made, for example, through the EDIT CAD MENU choice of menu 210 (FIG. 4).

Detailed Description Text - DETX (54):

As previously indicated, the user of the present invention typically accesses the system through a series of menu penetrations; in the preferred embodiment, this was accomplished through a menu software package sold by Magee Enterprises under the trademark "AutoMenu". The menu penetrations could begin as shown in FIG. 6. It is recognized by those skilled in the art that menu penetration systems can be arranged in many different ways to achieve the same end results. For example, a function which is required each time the system is executed could be automatically invoked rather than manually selected by the user. In using the series of menu presentations shown in FIG. 6, however, the user would typically begin by selecting CAD **DRAWING** choice 310 from menu 320. This choice would result in the display of a typical CAD Main Menu 410 depicted in FIG. 7. The FIG. 7 menu penetration system is a sample menu penetration system which provides the user with the functionality necessary to accomplish the functions of block 509 in FIG. 1, create/update job **drawings**.

Detailed Description Text - DETX (55):

Block 500 in FIG. 1, job takeoff, represents the typical initial step in performing a job estimate or creating a job **drawing**. When designing a building control system with the present invention, the user typically selects and modifies an initial **drawing** related to a building control system element by using a device such as a mouse, digitizer or joy stick or by using a keyboard.

Detailed Description Text - DETX (57):

When designing a building control system, the user of the present system is typically provided with a menu list of devices that can be chosen from to meet specific job or customer requirements. FIG. 16 illustrates a typical example of menu and prompt progression that occurs as the user completes a device choice. The first menu shown (identified as Screen 1) is an alpha-numeric listing of initial element identifiers. As soon as the user chooses an initial identifier, e.g., a basic model number such as HP972B, the prompt on Screen 1 changes to "Insertion point:". This coaches the user to position and insert the element in the desired location in the **drawing**. Based on the example shown in FIG. 16, the menu listing of Screen 2 is then displayed. Screen 2 may be used to list the specific model numbers available for selection, and a second display device 40 (FIG. 2) may be used to provide each specific model's characteristics through help messages. As shown in FIG. 16, the prompt line now reads "Enter identifier number (HP972B1005):". Note the default identity, HP972B1005, which may be chosen by entering a carriage return. The user then chooses, for example, HP972B1005 by either entering a carriage return or "clicking" on the screen menu location with, for example, a mouse or digitizer pen. A Screen 3 menu entitled "Select Quantity" may then be used together with a prompt such as "Enter desired quantity (1):". The default quantity (shown as 1) may be chosen by entering a carriage return, or values up to a predetermined number (e.g., 15) may be chosen with the digitizer or mouse. Quantities different than those listed on a quantity menu such as Screen 3 are normally entered through the keyboard.

Detailed Description Text - DETX (61):

The bill of materials is typically created by summing the component quantities which constitute a system **drawing** started in block 509. FIG. 8 demonstrates a typical menu penetration procedure for implementing the creation of a bill of materials. The FIG. 8 menu provides a choice of working on a proposal for a potential customer (the NEW PROPOSAL menu choice) or on a sold job (the NEW JOB menu choice).

Detailed Description Text - DETX (62):

(As previously indicated with respect to Block 510 as shown in FIG. 1, installation and engineering labor can also be calculated through the present system. Installation labor typically, includes the amount of time required for a workman to install a particular device in a building control system. Engineering labor typically includes the amount of time an application engineer requires to read the specification and to use the present system to lay out an installation diagram, produce job **drawings,** confirm device selection, and order devices.

Detailed Description Text - DETX (67):

Such a block 505 sizing program permits the user to automatically determine the size and model of a control valve or actuator required for a specific application. A selection is typically made in block 505 based on specified characteristics such as water flow in gallons per minute, steam flow in pounds per hour, etc. The user can either print a hard copy of the results on a printer (or create a copy on electronic media) and/or transfer the results through block 519 to block 509 for inclusion on the system **drawing**.

Detailed Description Text - DETX (77):

In this process, which normally begins with a series of prompts, the present system typically queries the user for device specifications, e.g., for valve and actuator job specifications. Typical valve queries include whether the valve is to be used for water or steam operation, whether the valve application requires a two-way or a three-way valve, the required flow rate, the desired pressure drop through the valve, etc. For actuators, typical queries include the desired spring range for the actuator and the desired action for the actuator, e.g., direct or reverse acting. Once the queries are answered, the system automatically displays a listing of applicable devices, e.g., of applicable valves and actuators. Based on the description displayed for each device model number (which is typically displayed on a screen), the user makes a selection. The user can then get a hard copy printout (or a copy on electronic media) of the resulting schedule or list, and/or transfer a copy through block 519 to block 517, job **drawing**. FIG. 10a-10b demonstrates a typical menu penetration procedure for implementing the selection of applicable valves and actuators.

Detailed Description Text - DETX (79):

Once all the materials necessary to implement a particular building control system have been sized and itemized, the cost of the installation materials can then typically be calculated. The cost of the device installation material may be calculated by matching the job **drawing** device number to the device number in data base records which contain the cost for that device.

Detailed Description Text - DETX (82):

Block 511 shows an example of an option for assembling a bill of materials or BOM (a bill of materials is sometimes referred to in the present application, particularly in the Figures, as a BOM). The assembly of the bill of materials typically starts by extracting the pertinent data such as alpha-numeric identifiers and quantities from the job **drawing**.

Detailed Description Text - DETX (83):

The bill of materials typically includes all the devices displayed on a building control system **drawing,** as well as those devices whose model numbers were generated by an element sizing program in block 505. Within job estimating, block 510, a generalized data base program typically collects quantity data for the bill of materials information from the devices listed on the **drawing** initiated in block 500, job takeoff.

Detailed Description Text - DETX (84):

After the bill of materials has been assembled, the user has the option, in block 512, of printing a hard copy (or creating a copy on electronic media) of the bill of materials and/or of exporting the bill of materials through block 519, for inclusion on the block 509 job **drawing**. Information from the bill of materials can also be passed to the job ordering program. FIG. 8 demonstrates a typical menu penetration procedure for implementing the creation of a bill of materials.

Detailed Description Text - DETX (85):

Block 507 optionally creates or updates job proposal records and/or sold job records. Within Block 507, a generalized data base program typically extracts job or proposal information from the system data base. Information can also be obtained by the system prompting the user for information regarding the specific job or proposal. Such records typically include job related information such as customer or contractor name, customer address, bid price, contract price, ordering information such as the dates the components were ordered, the architect name, the engineer's name assigned to the project, the proposal number and/or job numbers, etc. Other information tabulated for bookkeeping purposes includes the number of labor hours, and what equipment has been shipped or returned. **Drawing** information typically includes a **drawing** name. FIG. 9 demonstrates a typical menu penetration procedure for the block 507 record keeping system for job proposal records and sold job records.

Detailed Description Text - DETX (87):

Normally, job **drawings** include a control sequence of operation. A sequence of operation is a written description of how a building control system will operate. A building owner may refer to it when operating and maintaining a building system. Block 502, word processing, also provides the ability to modify standard sequences of operation, create new ones, store them, and add them to the applicable **drawings** Accordingly, block 519 optionally transfers the sequences of operation to the job **drawing** program in block 509 for inclusion on the job **drawing**.

Detailed Description Text - DETX (89):

Block 504 provides the user with the option of printing a hard copy of stored information, e.g., a sequence of operation (or of creating a copy on electronic media) or of transferring stored information, e.g., a sequence of operation to the job **drawing** (through block 519) for display in block 509. FIG. 13 demonstrates a typical menu penetration procedure for transferring information to the job specification **drawing**.

Detailed Description Text - DETX (92):

In block 517, the user has the option of printing (on hard copy or on electronic media) job **drawings, which are drawings** including information such as the building control system, sequences of operation, valve schedules, or a bill of materials. This will typically be done after the completion of a building control system design. FIG. 5 demonstrates a menu penetration procedure for moving the bill of materials and valve schedule to the **drawing** for subsequent printing.

Detailed Description Text - DETX (97):

The process described below includes the creation of a batch file and a script file designed to automatically execute a series of commands in order to automate an information transfer from Multimate Advantage to AutoCAD. In the preferred embodiment, this included the use of a conversion package, specifically the Technical Software, Inc. product sold under the trademark "AutoWord." This automatic transfer was then implemented through the menu of FIG. 5 by selecting "CONVERT WP DOCUMENT TO CAD **DRAWING**".

Detailed Description Text - DETX (100):

The batch file may be written so that it next erases the existing text **drawing** file (FILE1.DWG) from the AutoCAD directory.

Detailed Description Text - DETX (101):

The batch file then preferably executes AutoCAD, and passes parameters consisting of a default **drawing** name (FILE1.DWG) and a script file (FILE1.SCR).

Detailed Description Text - DETX (102):

The script file (FILE1.SCR) may be written and placed in the AutoCAD directory so that it automatically inserts the alpha-numeric information (e.g., the sequence of operations FILE1.DXF) information on the new **drawing** file (FILE1.DWG) using AutoCAD's DFXIN command.

Detailed Description Text - DETX (103):

The script file (FILE1.SCR) then preferably is written to prompt for the **drawing** name into which the newly created **drawing** file (FILE1.DWG) is to be inserted. At this point, the script file is typically written to complete execution and, after execution, control is returned to the user. The user then enters the correct job **drawing** file name and a carriage return.

Detailed Description Text - DETX (104):

Having completed execution of the batch and script files, the user then normally inserts the desired alpha-numeric information (e.g., the sequence of operation, **drawing** file FILE1.DWG) on the **drawing** selected. The user then saves the job **drawing** file and exits from AutoCAD, bringing him back to the main AutoCAD menu.

Detailed Description Text - DETX (106):

Having described in detail various functions and capabilities of the invention, the operation of the invention will now be explained further by way of expanding upon an example briefly described above. Referring again to FIG. 6, as noted above, the user of the present invention typically accesses the system through a serious of menu penetrations. These are shown in FIG. 6 as menu 320 having choices 310, 600, 602, 604, 606, 608, 610 and 612. These choices result in the routing of the system processing to various other menus via blocks 614, 616, 618, 620, 622, and 624. In using the series of menu presentations shown in FIG. 6, the user would typically begin by selecting CAD **DRAWING** choice 310 from menu 320. This choice would route the system via block 614 and result in the display of a typical CAD main menu 410 depicted in FIG. 7. As noted above, the FIG. 7 menu penetration system is a sample penetration system which provides the user with the functionality necessary to accomplish the functions of block 509 in FIG. 1, create/update job **drawings**. Further expanding upon this example, the user might then select from the CAD main menu 410 on FIG. 7 choice 626 to begin a new **drawing**. Having selected choice 626, the user is then presented with electric menu 628, pneumatic menu 630, standard menus 632 and CAD menus 634. The user would select the appropriate menu from these choices depending upon his needs for the particular job. If the user chooses, for example, standard menus 632 he would pull up the standard **drawing** and symbol names as represented by block 636. The user could then begin a new **drawing** using the standard **drawings** and symbol means. In a like manner, the use could choose other options from the CAD main menu as shown in FIG. 7 in order to, for example, plot a job **drawing** using plot parameters or add an existing **drawing**. All of the menu-driven displays would operate in a like manner with the exception that menu options differ for different operations.

Claims Text - CLTX (3):

(b) display means comprising a first display for displaying textual portions of the data and a second display for performing graphic **drawing** with associated commands;

Claims Text - CLTX (4):

(c) the processor means comprising means for calling up on the display an initial **drawing** related to a building control system element, the initial **drawing** comprising graphic and related alpha-numeric information including an identifier associated with the element and a prompt guiding modification of the initial **drawing**; and

Claims Text - CLTX (5):

(d) the processor means further comprising means for creating a modified **drawing** by incorporating changes into the initial **drawing** and means for estimating costs related to the building control system design wherein the modified **drawing** is related to a building control system design.

Claims Text - CLTX (9):

5. The system of claim 1 wherein the initial **drawing** related to a building control system element comprises a standard building control system element.

Claims Text - CLTX (10):

6. The system of claim 1 wherein the initial **drawing** related to a building control system element comprises a customized building control system element.

Claims Text - CLTX (11):

7. The system of claim 1 wherein an alpha-numeric identifier is located substantially adjacent to the element in the **drawing**.

Claims Text - CLTX (13):

9. The system of claim 1 wherein the means for calling up comprises a menu providing a list of alphanumeric identifier choice related to the initial **drawing** to be called up on the display.

Claims Text - CLTX (17):

13. The system of claim 12 wherein the processor means further comprises means for incorporating the sequence of operations into the modified **drawing**.

Claims Text - CLTX (21):

the help messages are displayed on the first display device and the **drawing** related to a building control system element is displayed on the second display device.

Claims Text - CLTX (37):

30. The system of claim 1 wherein the processor means comprises digitizer means comprising a surface and a pen, movement of the pen over the surface translating to movement of a position indicator on the display, the digitizer means facilitating use of the prompt and the means for creating a modified **drawing**.

Claims Text - CLTX (43):

36. The system of claim 35 wherein the means for creating a modified **drawing** comprises means for adding an additional element to the initial **drawing** by selecting the additional element from the first menu list.

Claims Text - CLTX (44):

37. The system of claim 35 wherein the means for creating a modified **drawing** comprises means for replacing a first element in the **drawing** with a second element listed in the first menu.

Claims Text - CLTX (45):

38. The system of claim 35 wherein the means for creating a modified **drawing** comprises means for deleting an element from the initial **drawing** by using the first menu.

Claims Text - CLTX (48):

the processor means further comprises means for creating a bill of materials for inclusion in the modified **drawing,** the bill of materials comprising a list of devices related to the element, an identifier of each device, the quantity of each device, and a description characteristic of each device.

Claims Text - CLTX (58):

49. The system of claim 48 wherein the means for creating a modified **drawing** comprises means for adding an additional element to the initial **drawing** by selecting the additional element from the first menu list.

Claims Text - CLTX (59):

50. The system of claim 48 wherein the means for creating a modified **drawing** comprises means for replacing a first element in the **drawing** with a second element listed in the first menu.

Claims Text - CLTX (60):

51. The system of claim 48 wherein the means for creating a modified **drawing** comprises means for deleting an element from the initial **drawing** by using the first menu.

Claims Text - CLTX (62):

the processor means further comprises means for compiling a job file of information including the modified **drawing** and selected supplemental alpha-numeric information from the data base, the job file describing a building control system design meeting specific customer requirements.

Claims Text - CLTX (77):

65. The system of claim 64 wherein the means for creating a modified **drawing** comprises means for adding an additional element to the initial **drawing** by selecting the additional element from the first menu list.

Claims Text - CLTX (78):

66. The system of claim 64 wherein the means for creating a modified **drawing** comprises means for replacing a first element in the initial **drawing** with a second element listed in the first menu.

Claims Text - CLTX (79):

67. The system of claim 64 wherein the means for creating a modified **drawing** comprises means for deleting an element from the initial **drawing** by using the first menu.

Claims Text - CLTX (81):

69. The system of claim 52 wherein the means for calling up comprises a menu providing a list of alpha-numeric identifier choice related to the initial **drawing** to be called up on the display.

Claims Text - CLTX (82):

70. The system of claim 52 wherein the initial **drawing** related to a building control system element comprises a standard building control system element.

Claims Text - CLTX (83):

71. The system of claim 52 wherein the initial **drawing** related to a building control system element comprises a customized building control system element.

Claims Text - CLTX (94):

82. The system of claim 81 wherein the processor means further comprises means for incorporating the sequence of operations into the modified **drawing**.

Claims Text - CLTX (98):

the help messages are displayed on the first display device and the **drawing** related to a building control system element is displayed on the second display device.

Claims Text - CLTX (108):

93. The system of claim 52 wherein the processor means comprises digitizer means comprising a surface and a pen, movement of the pen over the surface translating to movement of a position indicator on the display, the digitizer means facilitating use of the prompt and the means for creating a modified **drawing**.

Claims Text - CLTX (114):

99. The system of claim 98 wherein the means for creating a modified **drawing** comprises means for adding an additional element to the initial **drawing** by selecting the additional element from the first menu list.

Claims Text - CLTX (115):

100. The system of claim 98 wherein the means of creating a modified **drawing** comprises means for replacing a first element in the initial **drawing** with a second element listed in the first menu.

Claims Text - CLTX (116):

101. The system of claim 98 wherein the means for creating a modified **drawing** comprises means for deleting an element from the initial **drawing** by using the first menu.